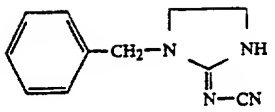
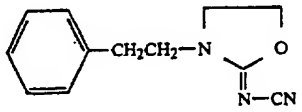


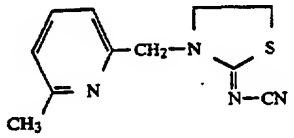
(described in Japanese Laid-Open Patent Publication No. 91064)

W-1



(described in the above-cited patent document)

W-2



(described in Japanese Laid-Open Patent Publication No. 196877/1984)

Q-1

EXAMPLE 6 (biological test)

Test on organophosphate-resistant green rice leafhoppers (*Nephotettix cincticeps*)

Preparation of a test chemical

Solvent: 3 parts by weight of xylene

Emulsifier: 1 part by weight of polyoxyethylene alkylphenyl ether

To prepare a preparation of a suitable active compound, 1 part by weight of the active compound was mixed with the above amount of the solvent containing the above amount of the emulsifier, and the mixture was diluted with water to a predetermined concentration.

Testing method

A water dilution of each of the active compounds in a predetermined concentration prepared as above was sprayed onto rice plants, about 10 cm [all] tall, grown in pots having a diameter of 12 cm at a rate of 10 ml per pot. The sprayed chemical was dried, and a wire net having a diameter of 7 cm and a height of 14 cm was put over each of the pots, and 30 female imagoes of rice leafhopper of a strain having resistance to organophosphate chemicals were released into the net. The pots were placed in a constant-temperature chamber. Two days later, the number of dead insects was examined. and the kill ratio was calculated.

Compared with comparison compounds W-1, W-2 and Q2 for example the following compounds according to the invention exhibited a considerably better [efficiacy] efficacy: Compound Nos. 4, 5, 8,9, 25, 27, 54, 65, 67, 69, 79.

EXAMPLE 7 (biological test)

Test on planthoppers

Testing method

A water dilution of each of the active compounds in a predetermined concentration prepared as in the preceding example was sprayed onto rice plants, 10 cm tall, grown in pots having a diameter of 12 cm at a rate of 10 ml per pot. The sprayed chemical was dried, and a wire net having a diameter of 7 cm and a height of 14 cm was put over each of the pots, and 30 female imagoes of brown planthopper (*Nilaparvata lugens*) of a strain having resistance to organophosphate chemicals were released into the net and the pots were placed in a constant temperature chamber. Two days later, the number of dead insects was examined, and the kill ratio was calculated.

In the same way as above, the kill ratio on white-backed planthopper (*Sogatella furcifera*) and organophosphate-resistant smaller brown planthopper (*Laodelphax striatellus*) was calculated.

Compared with comparison compounds W-1, W-2 and Q-1 for example the following compounds according to the invention exhibited a considerably better efficacy against brown planthoppers, brown smaller planthoppers and white-backed planthoppers: Compounds No. 4, 5, 8, 9, 25, 27, 65, 67.

EXAMPLE 8 (biological test)

Test on green peach aphids (*Myzus persicae*) having resistance to organophosphate and carbamate chemicals

Testing method

Bred green peach aphids having resistance to organophosphates and carbamates were inoculated on eggplant (black elongate variety) seedlings, about 20 cm tall, grown in unglazed pots having a diameter of 15 cm at a rate of about 200 per seedling. One day after the inoculation, a water dilution of each of the active compounds in a predetermined concentration prepared as in Example 6 was sprayed in sufficient amounts by means of a spray gun. After the spraying, the pots were left to stand in a greenhouse kept at 28° C. Twenty-four hours after the spraying, the kill ratio was calculated. The above test was carried out through two replicates.

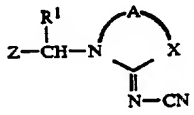
Compared with comparison compounds W-1, W-2 and Q-2 for example the following compounds according to the invention exhibited a considerably better efficacy against Myzus persicae: Compounds No. 4, 5, 25, 27, 65, 67, 69.

The biological tests shown in Examples 6, 7 and 8 are only typical examples of the insecticidal use of the compounds of this invention. The compounds of this invention shown herein are typical examples, and the utility of the invention is not to be limited to these examples alone.

It will be understood that the specification and examples are illustrative but not limitative of the present invention and that other embodiments within the spirit and scope of the invention will suggest themselves to those skilled in the art.

We claim:

1. A heterocyclic compound of the formula

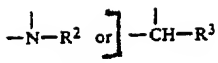


wherein

R^1 represents a hydrogen atom or a methyl group,

A represents an ethylene group which may be substituted by methyl,

X represents an oxygen or sulfur atom or the group



in which R² represents a hydrogen atom, a C_1–C_4 alkyl group which may be substituted by a substituent selected from halogens, C_1–C_4 alkoxy groups, C_1–C_4 alkylthio groups and cyano, a C_2–C_4 alkenyl group, a C_2–C_4 alkynyl group, a pyridylmethyl group which may be substituted by halogen and/or methyl, a benzyl group which may be substituted by halogen and/or methyl, a formyl group, an alkylcarbonyl group having 1 to 2 carbon atoms in the alkyl moiety which may be substituted by halogen, a phenylcarbonyl group which may be substituted by halogen and/or methyl, an alkoxy or alkylthiocarbonyl group having 1 to 4 carbon atoms in the alkyl moiety, a phenoxycarbonyl group, a C_1–C_4 alkylsulfonyl group which may be substituted by halogen or a phenylsulfonyl group which may be substituted by methyl,

R^3 represents a hydrogen atom or a C_1–C_7 alkyl group, and

Z represents a 3-pyridyl group or a 4-pyridyl group optionally substituted by at least one substituent selected from halogen atoms, alkyl groups having 1 to 4 carbon atoms, alkoxy groups having 1 to 4 carbon atoms, alkylthio groups having 1 to 4 carbon atoms, haloalkyl groups having 1 to 4 carbon atoms, haloalkoxy groups having 1 to 4 carbon atoms, alkylsulfonyl groups having 1 to 4 carbon atoms, a cyano group and a nitro group.

2. A compound according to claim 1, wherein

R^1 represents a hydrogen atom,

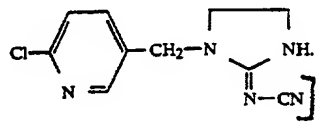
A represents an ethylene group,

X represents a sulfur atom or the group

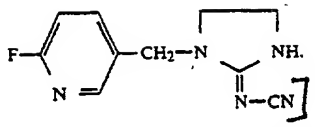
and

Z represents a 3-pyridyl group or a 4-pyridyl [gr] group optionally substituted by at least one substituent selected from a [flourine] fluorine atom, a chlorine atom, a bromine atom, a methyl group, a methoxy group, a methylthio group, a trifluoromethyl group, a trifluoromethoxy group, a methylsulfonyl group, a cyano group and a nitro group.

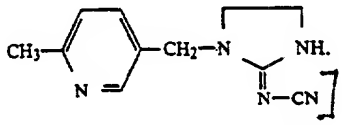
3. A compound according to claim 1, wherein such compound is 1-(2-chloro-5-pyridylmethyl)-2-cyanoiminoimidazolidine of the formula



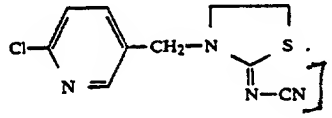
4. A compound according to claim 1, wherein such compound is 1-(2-fluoro-5-pyridylmethyl)-2-cyanoiminoimidazolidine of the formula



5. A compound according to claim 1, wherein such compound is 1-(2-methyl-5-pyridylmethyl)-2-cyanoiminoimidazolidine of the formula



6. A compound according to claim 1, wherein such compound is 1-(2-chloro-5-pyridylmethyl)-2-cyanoiminothiazolidine of the formula



7. An insecticidal composition comprising an insecticidally effective amount of a compound according to claim 1 and a diluent.

8. A method of combating insects which comprises applying to such insects or to an insect habitat an insecticidally effective amount of a compound according to claim 1.

9. The method according to claim 8, wherein such compound is

1-(2-chloro-5-pyridylmethyl)-2-cyanoiminoimidazolidine,

1-(2-fluoro-5-pyridylmethyl)-2-cyanoiminoimidazolidine,

1-(2-chloro-5-pyridylmethyl)-2-cyanoiminotetrahydropyrimidine,

1-(2-methyl-5-pyridylmethyl)-2-cyanoiminoimidazolidine,

1-(2-chloro-5-thiazolylmethyl)-2-cyanoiminoimidazolidine,

1-(2-chloro-5-thiazolylmethyl)-2-cyanoiminotetrahydropyrimidine,

1-(2-methyl-5-pyrazinylmethyl)-2-cyanoiminoimidazolidine,

1-(2-chloro-5-pyridylmethyl)-2-cyanoiminothiazolidine,

1-(2-chloro-5-pyridylmethyl)-2-cyanoiminotetrahydro-2H-1,3-thiazine

1-(2-chloro-5-thiazolylmethyl)-2-cyanoiminothiazolidine,

1-(2-methyl-5-pyrazinylmethyl)-2-cyanoiminothiazolidine,

1-(2-methyl-5-thiazolylmethyl)-2-cyanoiminothiazolidine, or

1-(1,2,5-thiaziazol-3-ylmethyl)-2-cyanoiminothiazolidine.

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